



Form PTO-1449 (modified)  
List of Patents and Publications  
For Applicant's Information  
Disclosure Statement  
(Use several sheets if necessary)

ATTY. DOCKET NO: 5119-12401

SERIAL NO: 10/824,772

APPLICANT: Koros et al.

CONFIRMATION NO.: 6708

FILING DATE: April 15, 2004

ART UNIT: 1724

**FOREIGN PATENT DOCUMENTS**

EXAM. INITIAL	REF. DES.	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUB CLASS	TRANSLATION YES/NO
JK	A33	0 446 947	5/24/1995	EP	_____	_____	
JK	A34	0 820 805	1/28/1998	EP	_____	_____	

**OTHER ART (Including Author, Title, Date, Pertinent Pages, Etc.)**

Exam. Initial	Ref. Des.	Article
JK	A01	Bai et al., "Metal-ion mediated separation of propylene from propane using PPO membranes," Journal of Membrane Science, 147(1998) pp. 131-139.
JK	A02	Bell et al., "Synthesis and Properties of Polyimidazopyrrolones," Journal of Polymer Science: Part A1 5(1967) pp. 3043-3060.
JK	A03	Bondi, "Catalog of Molecular Properties" in Physical Properties of Molecular Crystals, Liquid and Glasses, 1968, pp. 450-483 (Wiley, New York, NY).
JK	A04	Coleman, "Isomers of Fluorine Containing Polyimides for Gas Separation Membranes," Ph. D dissertation, University of Texas at Austin TX 1992. 252 pages
JK	A05	Freeman, "Basis of Permeability/Selectivity Tradeoff Relations in Polymeric Gas Separation Membranes", Macromolecules, 32(1999) pp. 375-380.
JK	A06	Ilinich et al., "Separation of ethylene and ethane over polyphenyleneoxides membranes: transient increase of selectivity", Journal of Membrane Sciences, 82(1993) pp. 149-155.
JK	A07	Ito et al., "Permeation of Propane and Propylene through Cellulosic Polymer Membranes," Journal of Applied Polymer Science, 38(1989) pp. 483-490 (Wiley, New York, NY).

EXAMINER:

*JK Lawrence*

DATE CONSIDERED:

6-806

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP 609;  
Draw line through citation if not in conformance and not considered. Include copy of this form with  
next communication to the patent owner.

Information Disclosure Statement--PTO 1449 (modified)

Form PTO-1449 (modified)		ATTY. DOCKET NO: 5119-12401	SERIAL NO: 10/824,772
List of Patents and Publications		APPLICANT: Koros et al.	CONFIRMATION NO.: 6708
For Applicant's Information		FILING DATE: April 15, 2004	ART UNIT: 1724
Disclosure Statement			
(Use several sheets if necessary)			

ff	A08	Kim et al., "Relationship Between Gas Separation Properties and Chemical Structures in a Series of Aromatic Polyimides", Journal of Membrane Science, 37(1988) pp. 45-62 (Elsevier, Amsterdam).
ff	A09	Kim et al., "Advanced Gas Separation Membrane Materials: Rigid Aromatic Polyimides," Separation Science and Technology, 23:12-13(1988) pp. 1611-1626 (Dekker, Inc.).
ff	A10	Kim, "Gas Sorption and Permeation in a Series of Aromatic Polyimides," Ph.D. dissertation, University of Texas at Austin, TX, 1988, 159 pages.
ff	A11	Koros et al., "Gas Separation Membrane Material Selection Criteria: Weakly and Strongly Interacting Feed Component Situations," Polymer Journal, 23:5 (1991) pp. 481-490.
ff	A12	Koros et al., "CO <sub>2</sub> Sorption in Poly(ethylene Terephthalate) above and below the Glass Transition," Journal of Polymer Science: Polymer Physics, 16(1978) pp. 1947-1963 (Wiley, New York, NY).
ff	A13	Koros et al., "Sorption and Transport of Various Gases in Polycarbonate," Journal of Membrane Science, 2(1977) pp. 165-190 (Elsevier, Amsterdam).
ff	A14	Lee et al., "Separation of propylene and propane by polyimide hollow-fiber membrane module," Journal of Membrane Science, 73(1992) pp. 37-45 (Elsevier, Amsterdam).
ff	A15	Olson et al., "Polarographic Study of Coordination Compounds with Delocalized Ground States. Substituent Effects in Bis- and Trisdithiodiketone Complexes of Transition Metals," Journal of the American Chemical Society, 88:21(1966) pp. 4876-4882 (American Chemical Society, OH).
ff	A16	Park et al., "Facilitated transport of olefin through solid PAAM and PAAM-graft composite membranes with silver ions," Journal of Membrane Science, 183(2001) pp. 163-170 (Elsevier, Amsterdam).
ff	A17	Petropoulos, "Quantitative Analysis of Gaseous Diffusion in Glassy Polymers," Journal of Polymer Science: Part A-2, 8(1970) pp. 1797-1801 (Wiley, New York, NY).

EXAMINER: Irish LauerDATE CONSIDERED: 6-8-06

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP 609;  
 Draw line through citation if not in conformance and not considered. Include copy of this form with  
 next communication to the patent owner.

Information Disclosure Statement--PTO 1449 (modified)

Form PTO-1449 (modified)  
List of Patents and Publications  
For Applicant's Information  
Disclosure Statement  
(Use several sheets if necessary)

ATTY. DOCKET NO: 5119-12401

SERIAL NO: 10/824,772

APPLICANT: Koros et al.

CONFIRMATION NO.: 6708

FILING DATE: April 15, 2004

ART UNIT: 1724

HL	A18	Pinnau et al., "Solid polymer electrolyte composite membranes for olefin/paraffin separation," Journal of Membrane Science, 184(2001) pp. 39-48 (Elsevier, Amsterdam).
HL	A19	Robeson, "Correlation of separation factor versus permeability for polymeric membranes," Journal of Membrane Science, 62(1991) pp. 165-185 (Elsevier, Amsterdam).
HL	A20	Scott et al., "Polyimidazopyrrolone Reverse Osmosis Membranes," Polymer Letters, 8(1970) pp. 563-571.
HL	A21	Shimazu et al., "Relationships between the Chemical Structures and the Solubility, Diffusivity, and Permselectivity of Propylene and Propane in 6FDA-Based Polyimides," Journal of Polymer Science: Part B: Polymer Physics, 38(2000), pp. 2525-2536 (Wiley, New York, NY).
HL	A22	Shimazu et al., "Relationships Between Chemical Structures and Solubility, Diffusivity, and Permselectivity of 1,3-Butadiene and n-Butane in 6FDA-Based Polyimides," Journal of Polymer Science: Part B: Polymer Physics, 37(1999) pp. 2941-2949 (Wiley, New York, NY).
HL	A23	Staudt-Bickel et al., "Olefin/paraffin separation with 6FDA-based polyimide membranes," Journal of Membrane Science, 170(2000) pp. 205-214 (Elsevier, Amsterdam).
HL	A24	Steel, "Carbon Membranes for Challenging Gas Separations," Ph.D. dissertation, The University of Texas at Austin TX, 2000, 199 pages.
HL	A25	Tanaka et al., "Permeation and separation properties of polyimide membranes to olefins and paraffins." Journal of Membrane Science, 121(1996) pp. 197-207 (Elsevier, Amsterdam).
HL	A26	Van Krevelen et al., "Volumetric Properties" in Properties of Polymers: Their Estimation and Correlation with Chemical Structure, 2 <sup>nd</sup> Edition, Elsevier, Amsterdam, 1976, pp. 51-79.
HL	A27	Vieth et al., "Dual Sorption Theory," Journal of Membrane Science, 1(1976), pp. 177-220 (Elsevier, Amsterdam).

EXAMINER:

Frank Lawrence

DATE CONSIDERED:

6-8-06

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to the patent owner.

Information Disclosure Statement--PTO 1449 (modified)

Form PTO-1449 (modified) List of Patents and Publications For Applicant's Information Disclosure Statement (Use several sheets if necessary)		ATTY. DOCKET NO: 5119-12401	SERIAL NO: 10/824,772
		APPLICANT: Koros et al.	CONFIRMATION NO.: 6708
		FILING DATE: April 15, 2004	ART UNIT: 1724
AL	A28	Walker, "Synthesis and Characterization of Polypyrrolones for Gas Separation Membranes," Ph.D. dissertation, The University of Texas at Austin, Texas, 1993, 188 pages.	
AL	A29	Walker et al., "Transport characterization of a polypyrrolone for gas separations," Journal of Membrane Science, 55(1991) pp. 99-117 (Elsevier, Amsterdam).	
AL	A30	Wang et al., "Toward Separation and Purification of Olefins Using Dithiolene Complexes: An Electrochemical Approach," Science, 291(2001) pp. 106-109.	
AL	A31	Zimmerman, "Advanced Gas Separation Membrane Materials: Hyper Rigid Polymers and Molecular Sieve-Polymer Mixed Matrices," Ph.D. dissertation, The University of Texas at Austin, TX, 1998, 322 pages.	
AL	A32	Burns, "Investigation of Poly(pyrrolone-imide) Materials for the Olefin/Paraffin Separation," Ph.D. dissertation, The University of Texas at Austin, TX, 2002, 213 pages.	
AL	A35	European Patent Office, "International Search Report," International Application No. PCT/US02/03962 mailed August 27, 2003, 7 pages.	
AL	A36	European Patent Office, "International Preliminary Examination Report" for International Application No. PCT/US02/03962 mailed September 19, 2003, 8 pages.	

EXAMINER:

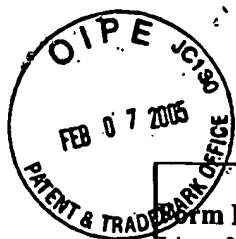
Frank Lawrence

DATE CONSIDERED:

6-8-06

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP 609;  
Draw line through citation if not in conformance and not considered. Include copy of this form with  
next communication to the patent owner.

Information Disclosure Statement--PTO 1449 (modified)



Form PTO-1449 (modified) List of Patents and Publications For Applicant's Information Disclosure Statement (Use several sheets if necessary)		ATTY. DOCKET NO: 5119-12401 APPLICANT: Koros et al. FILING DATE: April 15, 2004	SERIAL NO: 10/824,772 CONFIRMATION NO.: 6708 ART UNIT: 1724
<b>OTHER ART (Including Author, Title, Date, Pertinent Pages, Etc.)</b>			
Exam. Initial	Ref. Des.	Article	
JK	A37	Bell et al., "Polyimidazopyrrolones: A New Route to Ladder Polymers," Polymer Letters, 1965, Vol. 3, pp. 977-984.	
JK	A38	Berlin et al., "Thermostable Polymers from Dianhydrides of Aromatic Tetracarboxylic Acids and Tetra-amines," Russian Chemical Reviews, 1971, Vol. 40(3), pp. 284-300.	
JK	A39	Berry et al., "Cryoscopy on Sulfuric Acid Solutions of a Heterocyclic Polymer (BBB) and Related Compounds" Journal of Polymer Science: Polymer Physics Edition, 1974, Vol. 12, pp. 2253-2266 (Wiley, New York, NY).	
JK	A40	Bruma et al., "Synthesis of a Pyrrolone-Type Polymer Containing Anthraquinone Units in Molten Antimony Trichloride," Journal of Polymer Science: Polymer Chemistry Edition, 1974, Vol. 12, pp. 2385-2389 (Wiley, New York, NY).	
JK	A41	Colson et al., "Polybenzoylenebenzimidazoles," Journal of Polymer Science: Part A-1, 1966, Vol. 4, pp. 59-70.	
JK	A42	Dawans et al., "Polymers from <u>ortho</u> Aromatic Tetraamines and Aromatic Dianhydrides," Journal of Polymer Science: Part A, 1965, Vol. 3 pp. 3549-3571.	
JK	A43	Foster et al., "Polybenzimidazoles. IV. Polybenzimidazoles Containing Aryl Ether Linkages," Journal of Polymer Science: Part A, 1965, Vol. 3 pp. 417-412.	
JK	A44	Sulzberg et al., "Synthesis and Polymerization of a Dinitrobisphenol A: A new Polycarbonate Synthesis," Polymer Letters, 1969, Vol. 7, pp. 185-191.	
JK	A45	European Patent Office Communication, Search Report for EP application number: EP 0400 8852, mailed July 22, 2004, (6 pages).	
JK	A46	Allison et al., "Multicarrier Transport: Coupled Transport of Electrons and Metal Cations Mediated by an Electron Carrier and a Selective Cation Carrier," Journal of American Chemical Society, 1979, pp. 1333-1334.	

EXAMINER:

DATE CONSIDERED:

6-8-06

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP 609;  
Draw line through citation if not in conformance and not considered. Include copy of this form with  
next communication to the patent owner.

Information Disclosure Statement--PTO 1449 (modified)

Form PTO-1449 (modified) List of Patents and Publications For Applicant's Information Disclosure Statement (Use several sheets if necessary)		ATTY. DOCKET NO: 5119-12401 APPLICANT: Koros et al. FILING DATE: April 15, 2004	SERIAL NO: 10/824,772 CONFIRMATION NO.: 6708 ART UNIT: 1724
72	A47	Burns et al., "Defining the challenges for $C_3H_6/C_3H_8$ separation using polymeric membranes," Journal of Membrane Science, 2003, Volume 211, pp. 259-309. (Elsevier).	
72	A48	Fan et al., "How Electron Flow Controls the Thermochemistry of the Addition of Olefins to Nickel Dithiolenes: Predictions by Density Functional Theory," Journal of American Chemical Society, 2002, pp. 12076-12077.	
72	A49	Bickel, et al. "Olefin/paraffin gas separations with 6FDA-base polyimide membranes," Journal of Membrane Science, 2000, Volume 170, pp. 105-214.	
72	A50	Hashimoto, "Selective separation of olefins using dithiolene complexes. Electrochemical control," retrieved from STN, Chemical Abstracts Service, Database CHEMABS (online) Columbus, Ohio, abstract, 2001 (1 page).	

EXAMINER:

Frank Lawrence

DATE CONSIDERED: 6-8-06

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP 609;  
Draw line through citation if not in conformance and not considered. Include copy of this form with  
next communication to the patent owner.

Information Disclosure Statement--PTO 1449 (modified)

# ELECTRONIC INFORMATION DISCLOSURE STATEMENT

Electronic Version v18

Stylesheet Version v18.0

## Title of Invention

DITHOLENE FUNCTIONALIZED POLYMER MEMBRANE FOR  
OLEFIN/PARAFFIN SEPARATION

Application Number : 10/824772



Confirmation Number: 6708

First Named Applicant: William Koros

Attorney Docket Number: 5119-12401

Art Unit:

Examiner: Robert H. Spitzer

Search string: ( 3518232 or 4944880 or 4990275 or 4755192 or 4902422 or 3657190 or 3792024 or 4946594 or 4997906 or 5288304 or 5430218 or 5593157 or 6299669 or 6503295 or 6562110 or 6565631 or 6585802 or 6755900 or 3878109 or 5120825 or 5972080 or 4113683 or 5075419 or 5425801 or 3817386 ),pn

## US Patent Documents

Note: Applicant is not required to submit a paper copy of cited US Patent Documents

init	Cite.No.	Patent No.	Date	Patentee	Kind	Class	Subclass
77	1	3518232	1970-06-30	Bell			
	2	4944880	1990-07-31	Ho et al.			
	3	4990275	1991-02-05	Ho et al.			
	4	4755192	1988-07-05	Koros et al.			
	5	4902422	1990-02-20	Pinnau et al.			
	6	3657190	1972-04-18	Hughes et al.			
	7	3792024	1974-02-12	Saferstein			
	8	4946594	1990-08-07	Thaler et al.			
	9	4997906	1991-03-05	Thaler et al.			
	10	5288304	1994-02-22	Koros et al.			
	11	5430218	1995-07-04	Miller et al.			
	12	5593157	1997-01-14	Koros et al.			
	13	6299669	2001-10-09	Koros et al.			
	14	6503295	2003-01-07	Koros et al.			
	15	6562110	2003-05-13	Koros et al.			
	16	6565631	2003-05-20	Koros et al.			
	17	6585802	2003-07-01	Koros et al.			
	18	6755900	2004-06-29	Koros et al.			
	19	3878109	1975-04-15	Ikeda et al.			
	20	5120825	1992-06-09	Vora et al.			
77	21	5972080	1999-10-26	Nagata			

*Sub class 6-8-06*

<i>HL</i>	22	4113683	1978-09-12	Kalnin et al.				
<i>HL</i>	23	5075419	1991-12-24	Vora et al.				
<i>HL</i>	24	5425801	1995-06-20	Prasad				
<i>HL</i>	25	3817386	1974-06-18	Frost et al.				

**Signature**

Examiner Name	Date
<i>Frank Lawrence</i>	<i>6-8-06</i>



# ELECTRONIC INFORMATION DISCLOSURE STATEMENT

Electronic Version v18

Stylesheet Version v18.0

## Title of Invention

DITHIOLENE FUNCTIONALIZED POLYMER MEMBRANE FOR  
OLEFIN/PARAFFIN SEPARATION

Application Number : 10/824772



Confirmation Number: 6708

First Named Applicant: William Koros

Attorney Docket Number: 5119-12401

Art Unit: 1724

Examiner: Robert H. Spitzer

Search string: ( 2894988 or 4717394 or 5599380 or 5262056 or 5074891 or 6602415 or 6296755  
.pn

## US Patent Documents

Note: Applicant is not required to submit a paper copy of cited US Patent Documents

init	Cite.No.	Patent No.	Date	Patentee	Kind	Class	Subclass
HL	1	2894988	1959-07-14	Cryer			
	2	4717394	1988-01-05	Hayes			
	3	5599380	1997-02-04	Koros			
	4	5262056	1993-11-16	Koros et al.			
	5	5074891	1991-12-24	Kohn et al.			
	6	6602415	2003-08-05	Koros et al.			
HL	7	6296755	2001-10-02	Wang et al.			

## Signature

Examiner Name	Date
Frank Burre	6-8-06